hanging, that the whole may be in equilibrium. It is evident that one half A C, precisely balances at the point C the other half B C, and if either of these portions were removed, the other would immediately adjust itself in a vertical position. Let one half B C be removed, but suppose the other half to be prevented from regaining the vertical position by a force applied at the point C in the direction C M, make C M the measure of this force, and it will be the measure of the tension at the point C, or vertex of the curve, and is a constant quantity acting in that direction in every part of the semi-curve. Take any point *b*, and the tension at that point is equal to the result and of the force C M, and the weight of that portion of the curve *b c*, acting in the direction of gravity, and at the point of suspension A, it is equal to the resultant of the same force C M, and the weight of the semi-curve A C.

If the platform D E be attached to the curve with vertical bars as in fig. 6, the same effect

Fig. 6.

as exhibited above will still be produced, for this reason, viz. that, from the lines *a h*, *b g*, &c., acting vertically, there is the same weight conveyed to the chains, and in the same direction, as though there were no intervening suspending rods. Hence it is manifest that the whole of the horizontal force must be resisted by the chains at every part of them, and that at the centre the section of iron there must be sufficient to overcome the tension caused by it. In a chain or rope hanging in a pendant curve, fig. 5, this cannot be avoided, but in the case of a bridge which consists of curved and horizontal lines, it is clear that the vertical and horizontal forces should be divided, for it is enough for the chains of any bridge in their position of reduced power to support themselves, the platform, and the transit loads; besides, it is certain that the horizontal force, if existing in the chains, would tend to their destruction, but in the platform it is as essentially powerful for the support of the structure, as is the strength of the chains. This is evident from the fact, that in large spans on the catenary principle it has always been deemed advisable to strengthen the platform, and, further, to add to it deep and heavy trussing, to give additional stiffness to the structure; in short, to put a strain in the platform that ought to compensate for the horizontal force that ought to be there. In a word, the horizontal force here spoken of is analogous, and may be compared, as I before stated, to that force which is resisted in the solid bracket by the portion of material that is situated below the neutral line or axis C K, which, in a bridge on the catenary principle, must be sustained on tension wholly by the chains, and consequently the sectional area at the centre, corresponding with the junction of the brackets at C, must be sufficient to resist the action of that force; and the horizontal line or platform, which is, in fact, the same as the lower part of them, not having that force to resist, must be stiffened with planking, and trusses to check the undulation, and to render it safe for transit purposes. But if, instead of vertical we use the oblique suspending rods to support the platform, then the action of the forces in the structure is very different, and perfectly analogous to the brackets, as shewn in fig. 4, for each half of the bridge in this case may be considered independent of the other, but connected together at their extremities, and this we shall see immediately if we trace the action of the oblique rods in the same manner we have done to demonstrate the action of the vertical ones.

Let A C B, fig. 7, represent the chains of a suspension-bridge, the roadway of which is supported by the oblique bars *a h*, *b g*, &c.

Fig. 7.

Now, by examining their particular mode of action, we shall see that the constant horizontal force C M does not obtain, nor is there any tension at all existing in the chains at the point C, and for this reason the whole weight of the platform, D E, must be conveyed to the chain by means of the oblique rods connected thereto for that purpose; each of these bars will sustain and convey to the curve its proportion of the weight. Let us instance the one *d e*, and trace the effect of it on the system in sustaining that portion of the weight acting at the point *e*. Now the line *d e* is in an oblique direction with the horizon, and different to that in which the weight acts; therefore, in order that it may sustain that weight, it must be acted upon by two forces at the point *e*, one of these is the weight, the other is the horizontal force, in the direction D E; consequent upon that weight being supported at the angle *d e* D, or otherwise than in a vertical direction. Now the point *e* is situated in the platform, and therefore the horizontal force induced there must be resisted by it, and cannot be carried into or affect the curve beyond the point *d* towards C. The action of the other lines may be examined in the same manner; for instance, the tension in *c f* is induced by the action of the weight supported at *f*, and the horizontal force generated by that weight being resisted in an angle of less than 90°, and as the point *f* to which the various forces tend is in the horizontal line, the horizontal force acting there must be resisted by the platform, and cannot produce any effect in the chains beyond the point *e*, and so on for the remaining bars *h g*, *a h*: the weights suspended at the points *g* and *h* generating no horizontal force in the chains beyond the points *h* and *a*, the truth of which may be demonstrated in the same way as the bars just instanced. Therefore it follows that, though with the use of the vertical suspending rods, the variation of the tension, and of course the required proportionate variation of the section of iron in the chains, is so very inconsiderable as to be hardly worth notice, yet when the oblique bars are applied, the tension in the chain is reduced rapidly from base to the centre of the bridge, and, of course, in the same proportion may the section of iron in them vary also.

The valuable assistance the oblique rods give to the stability of a bridge may be understood by the following experiments:—Cut the chain in the middle, the bridge will stand as firm as ever, there being no strain there; then cut the platform in the middle, and the bridge will be separated into two independent brackets, each supported by the chain and the strength of the horizontal line against the abutment. The force required to resist this tendency is a measure of the power conferred upon the bridge by reason of the oblique rods, independent of the advantages gained by tapering the chains. On the other hand, cut the chains of a common bridge at the centre, and it will destroy the structure; or cut the platform in the middle, and leave the chain entire: then it will be seen that there is no tendency of thrust against the abutments, nor any horizontal force in the platform, and that it is the chain only which sustains the structure.

The principles of the cast-iron and stone-compression bridge are identically those of the common suspension-bridge reversed in position, and it is the most expensive system of construction.

This system is founded upon the principle of the lever, which is far less expensive than the common suspension-bridge. The greatest extent of span of an iron or stone compression-arch yet attained is 240 feet, that of a suspension-bridge 875 feet, but on these principles it could be extended with safety to above 4,000 feet. In the chains alone of the Menai bridge there is above 1,900 tons of iron, on this plan it would only require 75 tons.

JAMES DREDGE.

CEMETERIES.

We have lately touched upon this subject, and it will occur to us in the discharge of our duty to say much more upon it. What we have already said has stimulated some remarks, not in private alone, but of these it has been our lot to listen to not a few, and to suggestions that if we were to follow, would lead us into a labyrinth. There is, however, in some of these remarks, a challenging of coincidences that it were profitable to note, if what we should say passed not a step beyond the noting. For instance, a friend makes the observation "*à propos* of cemeteries, what do you think of Shillibeer's cemetery carriage?" "Think of it," we said, "we think very well of it." And because we think well of it, and because it is linked with the question of cemeteries, and because every country carpenter at least is an undertaker of funerals, and most London undertakers are not remotely connected with other undertakings advocated in THE BUILDER, and because cemeteries include cenotaphs, tombs, memorial tablets, and erections—because of all these it is urged upon us forsooth, that we should include cemetery or funeral carriages. Still our reason is not convinced, but we find on taking up Mr Pugin's late work, "An apology for the revival of Christian Architecture," that this subject is not beneath his ridicule, and as that is his natural vein, and ours is, perhaps, somewhat more inclined to gravity, especially on *grave* subjects, Shillibeer's funeral carriage claims from us a notice. We spoke of coincidences which had reference to the remark of our friend, to our writing, and also to our reading; but the key-stone of the arch of that ilk, is supplied by the following quotation, which most appositely and curiously fell in our way on communing with the venerated object of our biographical notice a week or two ago. With Wren at our backs we can venture to follow any precedent, and now we shall let our readers hear what that remarkable man so remarkably said, on the very subject of cemeteries and cemetery carriages:—

"I could wish all burials in churches and churchyards might be disallowed. It will be inquired where then shall be the burials? I answer, in cemeteries seated in the outskirts of the town; and since it is become the fashion to solemnize funerals by a train of coaches, even when the deceased are of moderate condition, though the cemeteries should be more distant, the charge need be little more than usual. The service might first be performed in the church; but for the poor and such as must be interred at the parish charge, a public hearse of two wheels and one horse may be kept at small expense, the usual bearers to lead the horse, and take out the corpse at the grave. In these places beautiful monuments may be erected, but yet the dimensions should be regulated by an architect, and not left to the fancy of every mason—for, thus, the rich, with large marble tombs, would shoulder out the poor—in these places the dead need not be disturbed at the pleasure of the sexton, or piled four or five upon one another, or bones thrown out to gain room."—*Sir Christopher Wren.*

In conning over our remarks, again, and mayhap fortified by this reading, we wonder at our lack of courage; but it is a hard thing to have a laugh against one, though it be an empty one. We have seen men ashamed of the truth, and deterred from doing a good action, less by the fear of what the world will say, bad as it is, than by the force of that basilisk spell which the *trader in satire* attains to the exercise of, among the weak and the pusillanimous of his victims. Is that product of human ingenuity, whether the result of accident or of motive or design, the less welcome to those who benefit by it? The horrors of a town church-yard! are then diminished to the poor because the wealthy alone can secure the decencies of transit to a suburban cemetery! And shall we not the rather hail that which will secure this to the poor than all the formalities and pragmatics of a master of ceremonies? This is done by Shillibeer's funeral carriage. Little, however, did Mr. Shillibeer think that he had an authority so high for his inventings—a suggestion so far outweighing in its force all the sneers of the satirist—the wisdom of Wren against the puerilities of Pugin.

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